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Conservation of native fauna inhabiting granite outcrops – how do you manage it?

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Abstract

Clearing for agriculture in the south-west of Western Australia has left numerous isolated granite outcrops as important refuges for native flora and fauna. Managing those outcrops requires some appreciation of the basic ecosystem processes that influence habitat quality. The abiotic factors that influence granite outcrop ecosystems include conserving soil and nutrients, minimizing excess nutrient input from external source, limiting surface water movements and the associated problems caused by increasing soil salinity, and fire management. Controlling exotic flora (weeds), fauna (feral animals) and pathogens (mostly fungi) are important biotic factors. Judicious use of herbicides and pesticides is also necessary to achieve management goals. In some situations the native flora and fauna can recovery naturally, but this will be dependent on the size of the granite outcrop and the associated fringing vegetation, the number of individual animals remaining and the potential for recruits to disperse into new habitats. Reintroduction of flora and some of the larger fauna species may be possible. However, by necessity some landowners may need to accept that not all outcrops can support all of the species they would like to see. Small animals and invertebrates that can survive on outcrops will invariably be easier to conserve than larger more charismatic species that can not survive indefinitely.

Keywords: granite outcrops, fauna, conservation

Introduction

The history of clearing of the southwest of Western Australia for agricultural development has been well documented (*e.g.* Saunders & Ingram 1987; Hobbs & Saunders 1993). The amount of remnant native vegetation remaining in varous shires encompassed by the southwest wheatbelt varies from 3-31% (Coates 1987). Amongst these small remnants of vegetation are areas of outcropping granite surrounded by narrow belts of woody perennial native vegetation growing on shallow soils (hereafter referred to as granite outcrops).

Until recently little attention had been paid to these granite outcrops or their flora and fauna. Granite outcrops are important areas of plant diversity (Hopper *et al.* 1997) with a high component of endemic species. Far fewer fauna species appear to be restricted to granite outcrops (Withers & Edward 1997; Bayly 1997) but the outcrops seem no less important to fauna as they provide refuges on a seasonal basis and during protracted periods of drought.

With the establishment of funding schemes by both the Commonwealth and State governments to promote biodiversity conservation and regeneration of native habitat within the agricultural landscape, private landowners now have the incentive and the means to integrate native ecosystem management with established farming practices. In those areas where granite outcrops are the main types of remnant habitat left in the landscape there is potential to develop networks of native vegetation with the outcrops as the central hub. If such systems can be established then fauna inhabiting the outcrops can disperse outwards from these refuges, or re-colonize outcrops from which they have become locally extinct.

The theory sounds reasonable, but what are the practical issues that landholders must deal with in order to conserve or re-establish native fauna? To create or maintain a healthy ecosystem that will be able to support a diverse range of species there must be a balance between inputs and outputs. This principle applies to nutrients, water, soil and plant biomass. Many of the activities associated with commercial farming have the capacity to lead, directly or indirectly, to the loss of some basic resources from the ecosystem while introducing excess quantities of others.

Successful management of native fauna is largely about managing the habitat that the animals need to live in. The quality and quantity of habitat that animals need to survive determines both the number of species and the total number of individuals that can inhabit an area. If the basic ecosystem processes that determine habitat quality are missing or incomplete, then small remnants can provide only limited habitat for native fauna. Before examining the potential for granite outcrops to support native fauna it is worthwhile taking the time to understand some of the basic ecosystem processes that determine habitat quality.

Soils and nutrients

The weathering of granite rock to create coarse soils and eventually finer soils is a slow process. Microflora (lichens and mosses) on the rock surface along with

rainfall and cycles of high and low ambient temperatures play an integral part in the creation of soils and the release of essential nutrients. These soils and nutrients are washed off the outcrops and accumulate around the base of the exposed granite. Shallow soils can support small plants, usually with shallow root systems. Deeper soils can support a wider array of species including larger, perennial shrubs and trees with deeper root systems. Generally, the more diverse the plant community around the outcrop, the more diverse is the animal community that inhabits the remnant.

Clearing or grazing of the fringing vegetation removes the nutrients faster than they can accumulate. At the same time compaction of the soil by stock and machinery can lead to rapid movement of surface water off the granite outcrop, eroding more soil and nutrients away from the system and into surrounding paddocks. This erosion can be damaging to surrounding crops, but the impact on the granite ecosystem is far greater. The best way to conserve the nutrients and soils associated with granite outcrops is to fence the remnant and exclude domestic stock. Funding schemes such as the Remnant Vegetation Protection Scheme and Natural Heritage Trust's *Bushcare* cater for this type of activity. Integrating the fencing with any future revegetation projects provides for economies of scale and can result in greater ease of management of farm activities.

If the loss of native vegetation and subsequent erosion is due principally to rabbits then it is important to control, and where possible, eradicate them. Agriculture Western Australia staff throughout the State can provide the most up to date advice on how to control rabbits. It is important that landowners obtain such advice as some of the control methods available (*e.g.* pindone grain baits) can pose serious risks to native wildlife if not carried out according to specific instructions.

If stock, feral goats or rabbits are not excluded from granite outcrops then these animals will deposit nutrients into the system in the form of dung. Nutrients can also enter granite outcrops ecosystems in the form of wind-borne dust during spreading of super phosphate. Many native plants, primarily of the Proteacea family (*e.g. Banksia, Hakea, Grevillea*), are not adapted to survive in nutrient-rich environments and can actually be killed by excess quantities of phosphorous and nitrates. The increased nutrients also provide an ideal environment for introduced weed species to establish and out compete the native flora.

Altered fire regimes

Fire is an integral part of native Australian ecosystems, but inappropriate regimes can have significant impacts on small remnants such as granite outcrops. While the exposed granite surface is often unaffected by fire, the fringing vegetation with its linear form is easily damaged. Fires that burn too hot to allow successful regeneration, or too cool to stimulate regeneration from native legume species (*e.g. Acacia* sp), or too frequently to allow any of the plants to reach maturity and begin producing viable seed, can drastically change the quality of granite outcrop habitat. Similarly, fires that burn in late spring may result in germination of seeds that subsequently die during the following hot, dry summer depleting the soil and above ground seed banks.

If exotic weed species have established amongst the fringing vegetation then they can greatly increase the amount of dry fuel that is available during the summer months, increasing the likelihood that a fire will spread, and greatly increase the intensity of the fire. Invasive weeds also have characteristics that enable them to rapidly colonize disturbed sites. Fire can provide enough disturbance to allow weeds to invade or regenerate more quickly than the native flora. It must also be remembered that many of the native plants inhabiting the fringes of granite outcrops live there only because of the moisture available year-round. As such they have very little tolerance of fire and can be removed from the system by fire.

Fire should be intentionally introduced to granite outcrop remnants only after much careful thought. Landowners should have a very clear idea of what they want to achieve with fire, and be sure that the type (*e.g.* hot or cool), size and timing (summer or autumn) of the fire will give the desired result. They also need to consider what impact the fire will have on the survival of those native animals residing on or around the outcrop. In most cases it is the last refuge these animals have in the farming landscape.

Fire is not always a bad thing as it can play an important role in recycling nutrients through the ecosystem. After prolonged fire-free periods most of the available nutrients are locked up in woody plants as above ground stems or below ground root systems. Fires convert woody materials to ash that is then dissolved in rainwater or run-off from the granite outcrop and taken up by regenerating plants. The elevated nature of granite outcrops means that fires that are followed shortly after by heavy downpours can result in the loss of much of the valuable ash and nutrients. In the wheatbelt this is not an uncommon sequence of events during the summer and autumn thunderstorm season, so landowners who consider using fire to manage their granite remnant must be aware of this risk.

Exotic flora

The impact of exotic weed species in terms of their contribution to increased fuel loads has been discussed in the section above. Exotic weeds also compete with native plants for sunlight and water, commodities that can be in short supply in habitats that still possess tall native shrubs or trees. Many of the exotic weeds encountered in our wheatbelt are annual plants, and they do not provide anywhere near as diverse or structurally complex habitats for small animals to live in. Exotic weeds growing around granite outcrops also create problems for farmers as they provide a source of seed that can re-infest surrounding farmland.

The communities of exotic plants that become established in many native remnants are usually dominated by annual grasses. These weeds are predominantly wind-pollinated and provide a little green feed for native herbivores such as kangaroos and wallabies, but offer no rewards to native insects or birds that require pollen, nectar or fruits to survive.

Exotic fauna

Exotic animals such as foxes, cats, feral goats, rabbits (and in the more remote arid areas feral donkeys) can all have significant impacts on the granite outcrops. Exotic herbivores remove native vegetation, prevent regeneration from rootstock or the establishment of seedlings, and introduce nutrients and exotic weed species to the site in their dung. The larger animals such as feral goats and donkeys can physically damage the granite outcrop ecosystem by dislodging small boulders and rock slabs and contributing to erosion by way of the pads or trails they create. They also consume considerable quantities of water from gnammas (rock pools) and damage wet seepage areas at the base of the granite outcrops.

The establishment and spread of exotic weeds is often aided by the grazing of domestic stock or rabbits, providing further reasons to exclude stock and control rabbits. Rabbits provide an attractive food source for foxes and feral cats, and can encourage greater numbers of exotic predators to persist in the area. This ultimately leads to the decline of native fauna as foxes and cats have catholic diets. Controlling rabbits, particularly if 1080 poison baits are used, can lead to a rapid reduction in fox numbers and can also lower feral cat numbers at times. Unfortunately, the benefits are seldom long lasting as dispersing juvenile foxes and feral cats soon move into the vacant habitat. Control of rabbits must be considered as an ongoing part of farm management.

At present control of feral cats is difficult since they are wary of traps, are difficult to shoot, and will seldom take conventional baits designed for foxes. While there is no doubt that feral cats eat a wide variety of native vertebrates and invertebrates (Martin *et al.* 1996), there is little direct evidence to suggest that they are a major threat to wildlife in most parts of the wheatbelt of Western Australia. In contrast the impact of feral cats on native fauna in more arid areas is much greater. Any humane methods that can be used to reduce feral cat numbers should be considered, but it may be more cost effective in terms of labour and materials to direct efforts towards habitat improvement to offset any impacts feral cats might cause.

Reducing fox numbers is an easier task. Breeding vixens and young cubs can be controlled in dens using fumigants, while independent animals can be shot, trapped or offered poison baits (1080 is the only registered bait). Contact your local Agriculture Western Australia office for the information sheets on which techniques best suit your circumstances and how to combine the various techniques with other farm activities. It is important to note that if landowners are using 1080 baits to control rabbits or foxes that farm dogs will be at risk unless they are kept confined while baits are in the field and are adequately muzzled when working in paddocks adjacent to baited areas. Some landowners have already decided that keeping working dogs on their farms in the presence of fox baits is not feasible, while others have learnt this lesson through experience.

Pathogens

There are a few fungal pathogens that can kill native flora and reduce the quality of the fringing vegetation in granite ecosystems. Many people will be familiar with 'dieback' (*Phytophthora cinnamomi*) which affects some eucalyptus species and a large number of Proteaceae species. There are also fungal stem cankers that can severely affect native vegetation.

Recently a new chytrid fungal pathogen (*Batrachochytrium dendrobatis*) has been recorded in Australia, and has been found to kill a number of our native frog species here in Western Australia. Frogs infected with this fungus have already been recovered from the wheatbelt.

None of these fungal pathogens can currently be controlled using chemicals, which means that the most effective means of limiting their effect is to prevent their introduction into an area in the first place. Landowners must take care to avoid transporting soil, plant material or mud adhering to farm vehicles into areas with remnant vegetation. Farm refuse sites should be located away from remnants and down-slope from them so that pathogens are not transported into the remnants by surface run-off.

Salinity

Rising water tables and the dissolved salts that they bring with them to the surface are major threats to remnant vegetation throughout the wheatbelt. Many granite outcrops are located high in the landscape and will not immediately be affected by salinity, but those situated in mid-slope areas or those situated in predominantly flat landscapes will be very susceptible to the effects of salinity. The salt will reduce the quality and quantity of the fringing vegetation and will also directly affect those species of animal (*e.g.* frogs) that require freshwater in which to reproduce.

The solutions to increasing salinity in the landscape have been the subjects of many workshops in their own right and will not be mentioned further here. Suffice to say that conserving natural ecosystems contained in isolated granite outcrops along with their flora and fauna will be difficult if salt problems in the surrounding landscape or drainage catchment are not adequately managed.

Herbicides and pesticides

Modern chemicals used to control plant and animal pests can adversely affect the quality of granite outcrop communities. If the chemicals are used in a manner other than that specified on the labels, then the fringing vegetation can be damaged or killed and the invertebrate and frog fauna can also be adversely affected. Herbicides and pesticides can get into the granite system either from direct application, as spray drift, or by leaching from empty stock drums dumped in or near the outcrop. Care needs to be taken to ensure that farm chemicals do not come in contact with granite ecosystems, unless landowners specifically want to apply them to achieve control of exotic plants and animals. Remember to read

the labels carefully, and if in doubt apply them to a very small area initially until the effects are fully known.

Not all herbicides are bad news for granite outcrops. A number of commercial products (*e.g.* Roundup Biactive® and Lontrel®, and grass-selective herbicides such as Fusilade®, Assure®, and Targa®) have been specifically developed for the control of exotic weed species, and have little or no adverse impact on native plant species. All herbicides and pesticides should be used according to the directions on the labels. Remember a little of a good thing is fine, but twice as much isn't twice as good.

The habitat's fine- what about the animals?

Habitat size

Assuming all of the issues mentioned above are in good order or under control, what things limit the range of animal species that a granite outcrop can support? The most important issue is the size of the fringing vegetation relative to the size of the granite outcrop. The larger the outcrop, the more complex it is structurally (*i.e.* boulder piles, crevices) and the wider the fringing vegetation surrounding the granite the more species (flora and fauna) the ecosystem will support and the larger the populations of individual species.

The world of invertebrates is often measured in terms of metres, while those of reptiles and frogs in tens of metres. Mammals and birds on the other hand have home ranges measured in terms of hectares, and some of the carnivorous mammals like chuditch (*Dasyurus geoffroii*) have home ranges of 1000-2000 ha. Clearly, if a granite outcrop is only a few hectares in area it will not be able to support a thriving population of chuditch. However, there is nothing to prevent the granite outcrop from being part of a chuditch home range if the remainder of the landscape caters for its needs.

The larger native mammal species, such as black-flanked rock-wallabies (*Petrogale lateralis*), quenda (*Isoodon obesulus fusciventer*) and woylie (*Bettongia penicillata ogilbyi*) may well have great appeal and receive most of the media attention. However, they are no more important than the trapdoor spiders living in the moss swards at the base of granites, or the tiny crustaceans that live and breed in the gnammas, or the yellow admiral butterflies (*Vanessa itea*) that congregate on the tops of the outcrops in late winter and spring. As custodians of granite outcrops we need to change our thinking a little and accept that each species is as important as the next.

Minimum viable populations

As the native vegetation is lost from the agricultural landscape the viability of native animal populations in remnants has declined. There are many cases where particular species are still present in a remnant or on a granite outcrop but their numbers have reached such a low level that the likelihood of them surviving for many more years is slim. There may not be enough choice of mates or enough habitat to support any young that are produced, or a mechanism for the young to disperse into new habitat. These are all symptoms of imminent local extinction of the native fauna. Being able to increase the size of fringing vegetation around outcrops by fencing and allowing regeneration, or by creating corridors to link adjacent outcrops, or simply creating corridors to other parts of the landscape, are all necessary if small populations of native animals are to increase. For specific details on how to achieve improved management of granite outcrops see Hussey (1998).

Know your fauna

The best way to make decisions about what remedial action is required for any particular granite outcrop is to find out what native fauna exists there. Surveying the native fauna is not as daunting a task as people might first think. There are simple methods that inexperienced people can use to quickly create a list of the main groups of animals that live on and around granites (see Sanders 1999). It is not necessary to be able to name every species encountered, but recognizing that one species is distinct from another and that it requires a particular type of habitat (*e.g.* gnammas, rock slabs, moss swards, hollow logs, *etc*) is important. Simple fauna surveys help define what actions are needed to conserve or restore a granite outcrop community, but more importantly they provide a useful means of raising the profile of many of the lesser known members of granite communities.

Watch and wait

With appropriate care and management many populations of native fauna inhabiting granite outcrops will recover of their own accord. Many of the invertebrates and some of the smaller vertebrates (e.g. frogs) will show signs of recovery within only a few years as they produce many young at a time and can breed for several months each year. Slower breeding species, including many of the reptiles and medium-sized mammals and birds will take longer to show signs of recovery. The sorry state of affairs we see today took decades to achieve, so we must be prepared to accept the fact that it may take nearly as long to reverse the situation.

The same techniques used to determine which species of fauna are present on granite outcrops can be applied to monitor the recovery of particular species, or the increase in the number of species using particular habitats. Some species of bird do not breed on or around granite outcrops at all, but visit them during the non-breeding period of each year. Seasonal use of the habitat the granite outcrop provides is just that, 'seasonal', and it will be influenced by many factors some of which operate in areas remote from the local area of the south-west wheatbelt. The failure of particular bird species to visit a granite outcrop in any year may have nothing to do with the habitat on the outcrop, but may simply mean the birds have found a better resource somewhere else that year. The true value of granite outcrops is seen in times of drought or when fire has temporarily removed alternative habitats.

Re-introducing fauna

For the past four years CALM has been actively re-introducing native fauna (mammals, some birds and one reptile) into areas from which they had become locally extinct. This program (called Western Shield) has been focused primarily on conservation estate (*e.g.* state forest,

Nature Reserves and National Parks), but the basic principles are equally applicable to private property. Before any species is re-introduced to an area a strict protocol (Anon 1995) is followed to determine why the species became locally extinct in the first place and to ensure that management practices are in place to combat the threatening process(es). No animals are re-introduced to an area until all of the problems are adequately addressed. A failure to do so means the animals are unlikely to survive and the effort of re-introducing the animals will have been wasted (not to mention the loss of valuable animals for no gain).

If landowners believe they have remnant habitat, including granite outcrops, that might be suitable for re-introducing native fauna (or flora) they are most welcome to contact CALM to discuss the matter. If they can satisfy the same criteria that CALM must meet (*i.e.*)

- adequate size and quality of habitat;
- security of habitat and control of access by livestock;
- adequate control of exotic weeds/predators; and
- adequate fire management

then much is possible. Conserving our native fauna is a task for all members of the community. Given that much of the remaining remnant vegetation and most of the granite outcrops are located on private property there is excellent potential for private landowners to become involved in this vital task. Granite outcrops provide ideal focal points to practice cutting edge conservation of our unique flora and fauna, integrated with modern farming enterprises.

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